13.container with CO_2 granules

These systems cooperative usage for eco-friendly power-generating equipment shutdown will be more efficient, because nytrogen and oxygen, which are generated by the cryogenic system, can be used for the severing cryo gas system.

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RECOVERY RESOURCE CHARACTERISTICS IN THE RBMK-1000 GRAPHITE STACKS

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Nuclear Power Plants’s safety operation is one of the most important ways of the nuclear power engineering development. The RBMK-1000 is one of the most used reactors in Russia. Now, RBMK produces electricity for region such as Leningrad Oblast, Kursk Oblast and Smolensk Oblast. In addition, in some CIS countries this reactor generates electricity. Therefore the graphite stacks deformation problem in the RBMK-1000 is the most relevant issue at the moment.

The graphite stack is the main RBMK-1000element. It is a neutron moderator and reflector. It consists of 2488 vertical graphite columns (blocks), which have height that is equal 7 m and its cross-section is 250x250 mm. Also the graphite stack contains fuel channels. [1]

Deformation in the graphite stacks is the cracks initiation and formation of fuel channels deflection. This deformation mechanism is related to progression and increasing of radiation defects in the graphite during reactor’s operating. The deformation causes are the following:

- Irradiation growth of the graphite
- Temperature non-uniformity
- Crack initiation
- Pressure of cracked blocks on other blocks

- Additional deflection from center to the edge

Currently, we have two ways that can solve the above problem:

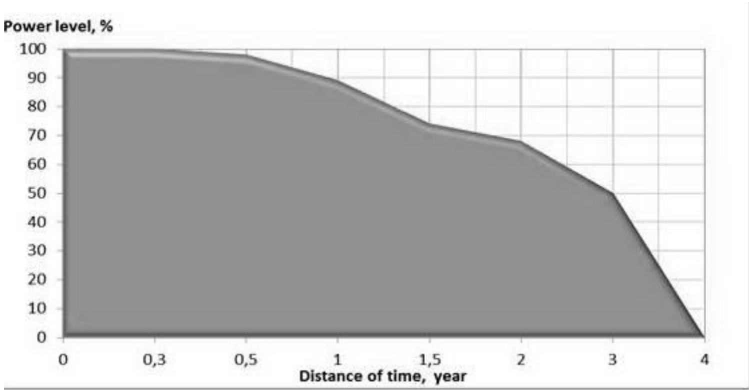
1. Extending the time of RBMK operation in nominal mode until the critical deflection is reached with the further decommissioning
2. Execution of the work to recovery reactor's resource characteristics (RRC)

Reactor's resource characteristics is called the complex of the alignment deflection fuel channels and the closing of cracks with using a special device.

The graph 1 shows that if reactor operates when critical deflection is reached then part of graphite blocks and fuel channels go out of service and the reactor's power gradually falls to zero. It means that the reactor become unserviceable and does not produce enough amount of energy for consumers. This causes profit loss. Also, when critical deflection is reached then the reactor cannot operate more than 2 years, because it can cause uncontrolled chain reaction and other crucial problems.

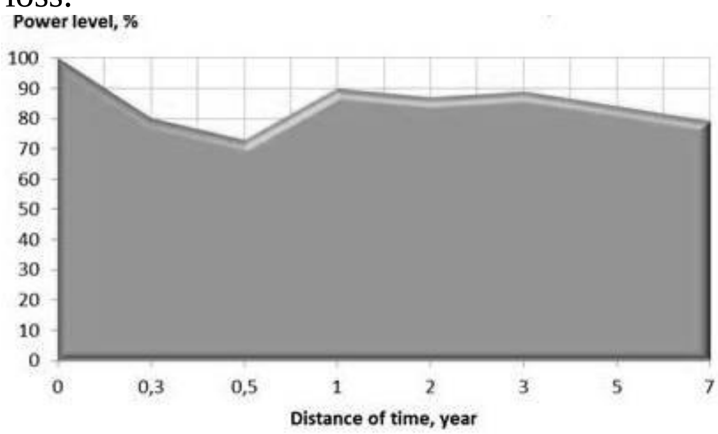
As for decommissioning then the cost of this process is approximately equal the cost of decommissioning of RBMK-1500 Ignalina NPP – 5 billion euro or 400 billion rubles.

For example, WWER-1200 can replace RBMK-1000, because WWER-1200 is easier to operate and it is more powerful. The construction of this reactor costs about 45 billion rubles.



Graph 1. Power level of reactor without RRC

Graph 2 illustrates reactor operation with recovery operation. If RRC is carried out then the reactor can operate on approximately 90-95 percent of nominal power after small losses of power during recovery operation (3-6 mounts). It means that the customers will be able to receive enough amount of electricity. Consequently there is almost no profit loss.



Graph 2. Power level of reactor with RRC

The total cost of the recovery operation for one RBMK unit is 2.5 billion rubles. Special devices for RRC and reactor's calibration cost 1.5 billion rubles. Replacement of the cracked fuel channels costs about 1 billion rubles. When this method is applied, the reactor's operating time increases for 5-15 years which can help our country to prepare for the future reactors' decommissioning and their gradual replacement.

In conclusion it's necessary to add that it is obvious that RRC is better than the first method, because it is more efficient and it can save huge amount of money (2.5 billion rubles vs. 400+45 billion rubles) and RRC can help to prepare for further reactors' decommissioning and their gradual replacement in the RF.

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AEROSOLS FORMATION AND ALTERATION SIMULATION IN THE PRIMARY HEAT CARRIER CIRCUIT OF A NPP'S REACTOR DURING A HYPOTHETICAL BEYOND DESIGN CONDITIONS ACCIDENT INVOLVING FISSION PRODUCTS RELEASE

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Aerosols formation and alteration simulation in the primary heat carrier, circuit of a NPP's reactor during a hypothetical beyond design conditions accident involving fission products release from fuel into the heat carrier's volume is a necessary condition for estimating the consequences from possible escape of radioactive particles to beyond the reactor pressure vessel boundaries with the following environment radioactive contamination. In the course of such an accident the fuel rods are heated to high temperatures, causing the heat carrier transferring from liquid state into aerosol. Particle unification is one of the most important mechanisms for further evolution of the generated particles. It is exactly the process that accounts for the major part of the computation time.